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L12: Entry 1 of 1 File: USPT Apr 27, 1976

US-PAT-NO: 3953644
DOCUMENT-IDENTIFIER: US 3953644 A

TITLE: Powa--method for coating and product

DATE-ISSUED: April 27, 1976

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Camelon; Melville J.	Utica	MI		
Vos; Arend W. D.	Birmingham	MI		

US-CL-CURRENT: 428/220; 427/195, 427/202, 427/379, 427/388.4, 427/407.1, 427/410, 428/413, 428/463, 525/155, 525/157, 525/161, 525/163, 525/327.3

CLAIMS:

We claim:

1. In a method for coating a substrate with diverse layers of coating material which comprises applying a heat-curable first coating material to said substrate, heating said substrate to at least partially cure said first coating material, applying a second coating material over said first coating material, and heating said substrate for a second time, the improvement wherein:

I. said first coating material is applied to said substrate as a dispersion of solids in an aqueous solution of a water-soluble amine and consists essentially of about 6 to about 60 parts by weight particulate pigment and about 40 to about 94 parts by weight of thermosetting paint binder which consists essentially of

A. 100 parts by weight acrylic paint binder resins consisting essentially of

1. about 5 to about 95 parts by weight of a solution polymer which is a carboxy-functional acrylic copolymer that

a. is at least partially neutralized with said aqueous solution of water-soluble amine,

b. is soluble in said aqueous solution,

c. has average molecular weight (M.sub.n) in the range of about 3,000 to about 20,000 and

d. has Tg in the range of -15.degree.C. to 50.degree.C. and,

2.

2. about 5 to about 95 parts by weight of an emulsion polymer having functionality selected from carboxy functionality and hydroxy functionality and is an acrylic copolymer. that

a. is essentially insoluble in said aqueous solution,

b. has average molecular weight (M.sub.n) in the range of about 3,000 to about 20,000 and

c. has Tg in the range of -15.degree.C. to 50.degree.C., and

B. about 15 to about 35 parts by weight of an amino resin crosslinking agent for said solution polymer and said emulsion polymer,

Ii. said first coating material is applied to said substrate to an average thickness in the range of about 0.4 to about 1.2 mils,

Iii. said first coating material is heated after application to said substrate and prior to application of said second coating material to said substrate by maintaining said substrate at a temperature in the range of about 200.degree.F. to about 350.degree.F. for a time in the range of about 5 to about 15 minutes, and

Iv. said second coating material is a particulate thermosettable mixture consisting essentially of an epoxy-functional acrylic copolymer of monoethylenically unsaturated compounds at least one of which is epoxy-functional and a cross-linking agent reactable with the epoxy functionality of said copolymer and selected from the group consisting of dicarboxylic acids and anhydrides of dicarboxylic acids, said crosslinking agent being present in an amount that provides about 0.8 to about 1.1 carboxyl groups or about 0.4 to about 1 anhydride group per epoxy group in said epoxy-functional acrylic copolymer and converts to a continuous, transparent coating upon maintaining said substrate at a temperature in the range of about 300.degree.F. to about 350.degree.F. for a time in the range of about 15 to about 30 minutes,

V. said second coatingg material is applied to said substrate as particulate solids to an average thickness in the range of about 0.8 to about 1.7 mils, and

Vi. said second coating material is heated by maintaining said substrate at a temperature in the range of 300.degree.F. to about 350.degree.F. for a

time in the range of about 15 to about 30 minutes. 2. A method in accordance with claim 1 wherein about 50 to about 65 weight percent of said dispersion of solids in an aqueous solution of water-soluble amine is water and said dispersion has a pH between 7 and 10.

3. A method in accordance with claim 2 wherein an equal volume of an essentially non-ionizable organic solvent for said solution resin is substituted for about 5 to about 20 volume percent of said water and said first coating material is applied to said substrate to an average thickness in the range of about 0.5 to 1.0 mil.

4. A method in accordance with claim 3 wherein said organic solvent is an alcohol.

5. A method in accordance with claim 1 wherein in addition to said solution polymer and said emulsion polymer, said dispersion of solids contains a stabilizer polymer which is a carboxy-functional acrylic copolymer that is soluble in said aqueous solution, has average molecular weight (M.sub.n) in the range of about 3,000 to about 8,000 and below that of said solution polymer and is present in said dispersion of solids in an amount in the range of 0.2 to about 10 weight percent of said emulsion polymer.

6. A method in accordance with claim 1 wherein said second coating material is applied to said substrate to an average thickness in the range of 1.0 to 1.5 mils and said epoxy-functional acrylic copolymer has average molecular weight (M.sub.n) in the range of about 1,500 to about 15,000 and glass transition

temperature in the range of about 40.degree.C. to about 90.degree.C.

7. In a method for coating a substitute with diverse layers of coating material which comprises applying a heat-curable first coating material to said substrate, heating said substrate to at least partially cure said first coating material, applying a second coating material over said first coating material, and heating said substrate for a second time, the improvement wherein:

I. said first coating material is applied to said substrate as a dispersion of solids in an aqueous solution of a water-soluble amine and consists of about 6 to about 60 parts by weight particulate pigment and about 40 to about 94 parts by weight of thermosetting paint binder which consists essentially of

A. 100 parts by weight paint binder resins consisting essentially of

1. about 5 to about 50 parts by weight of a solution polymer which is a carboxy-functional copolymer of acrylic monomers that

a. is at least parially neutralized with said aqueous solution of water-soluble amine,

b. is soluble in said aqueous solution,

c. has average molecular weight (M.sub.n) in the range of about 3,000 to about 20,000 and

d. has Tg in the range of -15.degree.C. to 50.degree.C., and

2. about 50 to about 95 parts by weight of an emulsion polymer having functionality and hydroxy functionality and is a copolymer of acrylic monomers that

a. is essentially insoluble in said aqueous solution,

b. has average molecular weight (M.sub.n) in the range of about 3,000 to about 20,000, and

c. has Tg in the range of -15.degree.C. to 50.degree.C., and

B. about 15 to about 35 parts by weight of an amino resin crosslinking agent for said solution polymer and said emulsion polymer,

Ii. said first coating material is applied to said substrate to an average thickness in the range of about 0.4 to about 1.2 mils,

Iii. said first coating material is heated after application to said substrate and prior to application of second coating material to said substrate by maintaining said substrate at a temperature in the range of about 200.degree.F. to about 350.degree.F. for a time in the range of about 5 to about 15 minutes, and

Iv. said second coating material is particulate film-forming material that converts to a continuous transparent coating upon maintaining said substrate at a temperature in the range of about 300.degree.F. to about 350.degree.F. for a time in the range of about 15 to about 30 minutes,

V. said second coating material is applied to said substrate as particulate solids to an average thickness in the range of about 0.8 to about 1.7 mils, and

Vi. said second coating material is heated by maintaining said substrate at a temperature in the range of 300.degree.F. to about 350.degree.F. for a time in the range of about 15 to about 30 minutes.

8. An article of manufacture comprising a substrate, a pigmented layer of a first coating material adhered to said substrate and a transparent layer of a

second coating material opposite said substrate wherein:

I. said first coating material is applied to said substrate as a dispersion of solids in an aqueous solution of a water-soluble amine and consists essentially of about 6 to about 60 parts by weight particulate pigment and about 40 to about 94 parts by weight of thermosetting paint binder which consists essentially of

A. 100 parts by weight paint binder resins consisting essentially of

1. about 5 to about 95 parts by weight of a solution polymer which is a carboxy-functional acrylic copolymer that

a. is at least partially neutralized with said aqueous solution of water-soluble amine,

b. is soluble in said aqueous solution,

c. has average molecular weight M.sub.n in the range of about 3,000 to about 20,000 and

d. has Tg in the range of -15.degree.C. to 50.degree.C., and

2. about 5 to about 95 parts by weight of an emulsion polymer having functionality selected from carboxy functionality and hydroxy functionality and is an acrylic copolymer that

a. is essentially insoluble in said aqueous solution,

b. has average molecular weight (M.sub.n) in the range of about 3,000 to about 20,000, and

c. has Tg in the range of -15.degree.C. to 50.degree.C., and

B. about 15 to about 35 parts by weight of an amino resin crosslinking agent for said solution polymer and said emulsion polymer,

Ii. said first coating material is applied to said substrate to an average thickness in the range of about 0.4 to about 1.2 mils,

Iii. said first coating material is heated after application to said substrate and prior to application of said second coating material to said substrate by maintaining said substrate at a temperature in the range of about 200.degree.F. to about 350.degree.F. for a time in the range of about 5 to about 15 minutes, and

Iv. said second coating material is a particulate thermosettable mixture consisting essentially of an epoxy-functional acrylic copolymer of monoethylenically unsaturated componds at least one of which is epoxy-functional and a cross-linking agent reactable with the epoxy functionality of said copolymer and selected from the group consisting of dicarboxylic acids and anhydrides of dicarboxylic acids, said crosslinking agent being present in an amount that provides about 0.3 to about 1.5 functional groups reactable with said epoxy-functional copolymer per functional group on said epoxy-functional copolymer and converts to a continuous, transparent coating upon maintaining said substrate to a temperature in the range of about 300.degree.F. to about 350.degree.F. for a time in the range of about 15 to about 30 minutes,

V. said second coating material is applied to said substrate as particulate solids to an average thickness in the range of about 0.8 to about 1.7 mils, and

Vi. said second coating material is heated by maintaining said substrate at a temperature in the range of 300.degree.F. to about 350.degree.F. for a time in the range of about 15 to about 30 minutes.

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L16: Entry 1 of 1 File: USPT Jan 5, 1999

DOCUMENT-IDENTIFIER: US 5855964 A
TITLE: Powder clearcoat and process for the production of a multicoat finish

US PATENT NO. (1):
5855964

Abstract Text (1):
The invention relates to a process for the production of a multicoat finish, in which a pigmented basecoat is applied, dried and coated over with a powder clearcoat, and subsequently basecoat and powder clearcoat are stoved together. The invention is characterized in that the powder clearcoat employed has a particle size distribution in which

Brief Summary Text (4):
(1) a pigmented basecoat is applied to the substrate surface,

Brief Summary Text (6):
(3) a powder clearcoat is applied to the resulting basecoat, and subsequently

Brief Summary Text (7):
(4) the basecoat is stoved together with the powder clearcoat.

Detailed Description Text (2):
In step (1) of the process, it is in principle possible to employ all pigmented basecoats which are suitable for the production of multicoat finishes. Such basecoats are well known to those skilled in the art. Both water-dilutable basecoats and basecoats based on organic solvents can be employed. Suitable basecoats are described in, for example, U.S. Pat. No. 3,639,147, DE-A-33 33 072, DE-A-38 14 853, GB-A-2 012 191, U.S. Pat. No. 3,953,644, EP-A-260 447, DE-A-39 03 804, EP-A-320 552, DE-A-36 28 124, U.S. Pat. No. 4,719,132, EP-A-297 576, EP-A-69 936, EP-A-89 497, EP-A-195 931, EP-A-228 003, EP-A-38 127 and DE-A-28 18 100.

Detailed Description Text (3):
In step (2) of the process, the solvents or the water are/is removed in a flash-off phase from the basecoat applied in step (1). The basecoat can also be stoved. However, this is disadvantageous on economic grounds, since in this case two stoving procedures instead of one are required to produce the multicoat finish.

Detailed Description Text (16):
A commercially available, water-dilutable basecoat containing polyurethane, polyester and melamine resin and pigmented with aluminum flakes is applied to phosphated steel panels coated with a commercially available electrodeposition coating and a commercially available filler such that a dry film thickness of from 12 to 15 .mu.m is obtained. The applied basecoat is dried for 10 minutes at room temperature and for 10 minutes at 80.degree. C. The powder clearcoats prepared according to sections 1. and 2. are then applied electrostatically to give a film thickness of from 40 to 50 .mu.m. Finally, basecoat and powder clearcoat are stoved for 20 minutes at 180.degree. C. (panel temperature). The metallic finish produced using the powder clearcoat prepared according to section 2. indicates a distinctly improved leveling in comparison to the metallic finish produced using the powder

clearcoat prepared according to section 1. In the profilometric measurement of the clearcoat surfaces, a peak-to-valley height R.sub.a of 0.36 .mu.m with a standard deviation of 0.14 .mu.m is measured for the finish produced using the powder clearcoat according to section 1, whereas, for the finish produced using the powder clearcoat according to section 2, in accordance with the invention, a peak-to-valley height of only 0.14 .mu.m with a standard deviation of only 0.01 .mu.m is measured. The improved evenness of surface achieved using the powder clearcoat according to the invention is also clearly visible to the eye.

CLAIMS:

5. Process for the production of a multicoat finish on a substrate surface, comprising

(1) applying a pigmented basecoat to the substrate surface,

(2) forming a polymer film from the basecoat applied in step (1),

(3) applying a powder clearcoat to the resulting basecoat, and subsequently

(4) stoving together the basecoat and the powder clearcoat,

wherein the powder clearcoat employed in step (3) is a powder clearcoat according to claim 1.